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shores of Spitzbergen in enormous masses. I shall also endeavour to utilise the native coal, which I have seen cropping out of the precipices in various places.

"I think I have succeeded in getting together a first-rate crew, six of whom, besides myself, have had considerable Arctic experience. I have got a surgeon, Mr. Smith, who is somewhat of a naturalist, and anxious to make any scientific researches and observations in his power.

"I hope to be in Tromsö by the 1st May, which will give me full four months of good Arctic summer for my explorations.

"I am, my dear Sir Roderick, yours very sincerely,
"J. LAMONT.

"Sir R. Murchison, Bart., F.R.S."

The following Papers were read:—

1. *On the Evidences of the Gulf Stream in High Latitudes in the North Atlantic.* By Admiral C. IRMINGER, Corr. Member R.G.S.

Copenhagen, April 21st, 1869.

I HAVE read with the greatest interest the discussions in the Royal Geographical Society, at the Meeting, February 8th, between Mr. Findlay, Captain Sherard Osborn, R.N., and Professor Huxley, concerning the Gulf Stream.

For nearly thirty years I have, partly myself, partly through naval friends and intelligent ship-masters, who with me take interest in oceanic currents, made observations on currents and temperatures, chiefly of the Northern Atlantic Ocean. I have always, nearly every year, furnished them with well-corrected thermometers; and these observations on the water which comes from more southerly and more heated parts of the Atlantic, and also on the waters of what I believe to be the Gulf Stream, I take the liberty of submitting to the Royal Geographical Society.

The chart which I send [which was exhibited to the Meeting] shows the temperatures between Shetland and Greenland, and the accordance existing between the many annual observations in my possession, of which I have only marked the temperatures for a few years.

According to these observations, it can be said, with certainty, that the current in the Northern Atlantic flows towards the North, even up to the Icy Sea.

In a treatise on currents of the ocean (Havets Strömninger; Nyt Archiv for Sövæsenet, 1853) I have published the observations, made with all possible accuracy, in one part of the North Atlantic, by seven of our men-of-war, provided with superior chronometers and other instruments; and a medium of these observations in different years gave:—

Between 59° 30′ and 61° 30′ lat. N.
and 2° ,, 6° W. of Greenw. } in 17 days,* the current was found 4·7 nautical miles per day, N. 72° E. true.

Between 60° 0′ ,, 62° 0′ lat.
and 6° 0′ ,, 10° 0′ W. Greenw. } 11 days, 2·5 nautical miles per day, N. 60° E. true.

Between 60° 30′ ,, 62° 30′ lat.
and 10° 0′ ,, 14° 0′ W. Greenw. } 18 days, 0·8 nautical mile per day, N. 32° E. true.

Between 61° 0′ ,, 63° 0′ lat.
and 14° 0′ ,, 18° 0′ W. Greenw. } 25 days, 3·1 nautical miles per day, N. 47° E. true.

Between 62° lat. and the south coast of Iceland, and 18° and 23° W. of Greenwich (nearly the longitude of Cape Reikianæs, south-west cape of Iceland) in 32 days, 1·91 nautical mile per day, N. 33° W. true.

Between Fairhill and Greenland, the weather was frequently unfavourable for observations for correcting the longitude, but still a constant drift, or slow current of the ocean to the north was observed, and the mean of observations between 32° and 39° W. of Greenwich gave 3·2 nautical miles per day, N. This drift of the ocean in a northerly direction towards the coast of Greenland is besides observable in the temperature of the water.

This drift, or slow current, in the Atlantic is the cause why the harbours of Norway, even farther than North Cape, and as far as the Fiord of Varanger, are accessible for navigation during the whole year; just as the warm current, which passes Cape Reikianæs, and runs to the northward along the western shores of Iceland, is the cause of the south and west coasts of this island being clear of ice, so that, even during the severest winters, ships may go to Havnefiord and other places in the Faxe Bay of Iceland, where they always will be sure of finding open sea. If this current to the north in the Atlantic did not exist, the ice from the sea around Spitzbergen would float down to far more southern latitudes than is now the case; and certainly the coasts of Norway, as well as the sea between Shetland and Iceland, would frequently be filled with ice from the Icy Sea, and the influence of the ice would then be felt on the climate of the neighbouring coasts. But this is not the case; and we know that the ice from the Icy Sea (Greenland-ice) only can force its way to the southward between Iceland and Greenland, along the east coast of Greenland, rounding Cape Farewell and afterwards passing Labrador, Newfoundland, and farther south.

Along the north coast of Iceland the current is usually to the eastward, and along the east coast predominating to south; and I think these currents may be considered as eddies of the principal currents in the Icy Sea and the Atlantic.

The current and the ice-drift of the Greenland-ice are sometimes so considerable, that not only the sea between Cape North of Iceland and Greenland is blocked up with ice, but it also strikes against the north coast of Iceland between Cape North and the Bay of Skayestrand, and then, favoured by the said eddies, closes the north and east coast of Iceland entirely. On the 24th of May, 1840, this ice was met with even about 100 nautical miles from the east coast. Still this ice never remains on these coasts later than the month of August, but generally leaves earlier, and then swings round in a north-east direction to the Icy Sea again.

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* I reckon a day = 24 hours.

The temperature of the sea seems to prove that the warmer current of the Atlantic approaches as well the east as the north coast of Iceland more in summer than earlier in the year.

It happens, notwithstanding, that a small part of that ice which now and then encloses the east coast is, by gales from north and north-east, carried to the south shore of the island; but as soon as it appears here it is carried away again with the north-westerly current from the Atlantic, passing Cape Reikianæs, and thus onward to the other ice, constantly blocking up the east coast of Greenland.

The enclosed description* of the currents and ice-drifts near Iceland will give more detailed information for those who may wish it; but I must observe expressly, that the ice which now and then encloses the above-mentioned coasts of Iceland never is met with in lower latitudes, as would be the case if the current or drift of the Atlantic were not towards the north.

By studying the temperature of the North Atlantic between Shetland and Cape Farewell, it will be observed that *streaks of warmer water* are found here, some of which I have indicated on the appended sketch. These warmer streaks are not to be found every year in the same longitude, and I think they have their origin from the Gulf Stream, which has retained this higher temperature, and that these warmer streaks, sometimes met with more easterly or at others more westerly, possibly may be caused by the pressure of the current coming from Labrador, passing Newfoundland, &c.; where this current influences more or less the limits of the Gulf Stream, causing its heated water to be inclined sometimes more easterly and at other times more westerly. Severe gales might likewise possibly have an influence on this deviation.

These warmer streaks, combined with the different tropical products constantly thrown on the shores of Norway, the Faröe Isles,

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* 'Strømninger og Iisdrift ved Island:' a printed pamphlet, now in the Library of the Society.—[ED.]

Iceland, Greenland, &c., I believe also to be a proof that the Gulf Stream sends its waters far to the north.

Among the tropical products frequently found is the bean of the *Mimosa scandens*, one of which I send you, and which I found on the shores of Iceland. Near Husavik (North Iceland) I once picked up on the beach so large and fine a specimen of this mimosa, that I had a snuffbox made of it.

The enclosed description of the currents will show, that Capt. Södring, in the *Fox* (the same vessel which Captain Sir Leopold M'Clintock commanded on the Franklin expedition), on the 7th of March, 1860, in 66° 21′ lat. N., and 1° 26′ long. W., found the water on its surface, after the long winter's influence in these cold climates, still at 4° R. or 41° Fahrenheit.

With all these facts it appears to me, that the Gulf Stream can be followed through the Northern Atlantic, even up to the Icy Sea.

I have limited myself to the above short report, as many distinguished Fellows of the Royal Geographical Society are so well acquainted with the currents of the ocean, that I find it superfluous to add more circumstantial details concerning this matter.

Most respectfully,
C. IRMINGER,
Rear-Admiral, Royal Danish Navy.

2. *On the Surface Temperature of the North Atlantic, in reference to Ocean Currents.* By NICHOLAS WHITLEY, C.E.

THE thermometrical observations on which this Paper is founded were commenced on the Cornish coast in 1849, and were afterwards extended to the Scilly Isles, the Seven Stones Light-ship, to Yarmouth, and to the Shetland Isles. And, further, in order to ascertain the temperature of the surface water across the Atlantic, extracts were made from the log-books of Cunard's steam-ships sailing between Liverpool and New York, for a period of five years; which have been reduced to monthly means at every five degrees of longitude, and are embodied in the table appended to this Paper.

The primary object was an endeavour to determine the influence of the Gulf Stream on the climate and agriculture of the British Isles.

In this Paper I purpose only to state the general results obtained, and to apply the evidence as a test of the existence of ocean currents.